Example Descriptions for Study Lesson Plans[1]

I. Background information

A. Goal of the Lesson Study Group

Example 1 (Tsuta Elementary School, Hiroshima, Japan)

The students at this school are cheerful, obedient and are very enthusiastic about learning. However, it seems as if they have not acquired the skills to think deeply about one problem, listen and pay attention to the comments of other students, and respect the opinions of other students. Moreover, as the students reach the upper grade levels (fifth and sixth grade), they become more and more afraid of making mistakes in front of other students. As a result of this fear, they become less willing to be active participants in the learning process. In order to address these problems, our school decided on the topic "Promoting students' ability to think on their own, invent, and learn from each other." We felt that by choosing this topic, we could build on each student's strong desire to learn (when they face a new subject) and teach them how to enhance their learning from other students' ideas and from their mistakes (and the mistakes of others), while at same time fostering a feeling of success among all the students.

Example 2 (Greenwich Japanese school)

During the past five years we have been developing and refining our schools' mathematics goal "the development of instruction that fosters students' mathematical and logical thinking (reasoning) abilities in order to improve mathematics education in grades 1 through 9."

There are important reasons why we have kept the same goal for such an extended period of time. In general, our students have a great understanding and rich knowledge of mathematics. However, they have a tendency to look for the right answers without thinking about the problem deeply. For example, they can solve problems using formulas, but they lack understanding of why such formulas were created. Therefore we have endeavored to teach lessons that foster mathematical thinking and expressive abilities. In addition, we have tried to prepare lessons that help students discover the merit of mathematical thinking through mathematical activities, as well as lessons for which students are asked to write reports and present them to their class, instead of asking them to solve problems during class time. Moreover while we have tried to rear such ability among our students, we have also carefully poured over the contents of the textbooks and tried to establish students' basic knowledge/skills. We also have tried to value during the process of problem solving honest student voices such as "why did it become this way?"

B. Narrative Overview of Background Information

Example from a 2nd grade lesson (Greenwich Japanese School, Greenwich, Connecticut)

Students have already acquired the concepts of triangle (right triangle) and quadrilaterals (square and rectangle) and how to draw them. They have used rulers and triangular squares to understand plane figures. This lesson's purpose is to summarize the unit. Hands-on activities are created to make students approach the problems as if they were playing games. The problems are also designed to help the students feel a sense of accomplishment and fulfillment when they finally solve them. With activities such as "pattern

[1] The examples from the school in Hiroshima, Japan were collected by Makoto Yoshida and those from the Greenwich Japanese School were collected by Clea Fernandez and Makoto Yoshida.

blocks" and "animal bingo" we encourage the students to use predictions for approaching problems solving. Team teaching will allow us to pay attention to all of the students and to instruct them individually. The following are points for consideration;

1) Create a learning environment where students enjoy learning as well as fell accomplishment and fulfillment when they finally solve the problem. Encourage students to use the knowledge, skills, and approaches they have acquired in order to solve the problems with logical thinking. With the help of team teaching, try to assess each student's understanding, and approach each student as an individual.
2) Use the group activities to help students interact with each other, compete with each other and acknowledge each other's good qualities.

Example from a first grade subtraction lesson (Tsuta Elementary School, Hiroshima, Japan)

Until now, the students have been studying the concept of subtraction by finding the remainder and the difference, situations where borrowing is not necessary. Moreover, by composing and decomposing numbers, the students have been able to notice the different forms in which a number can be expressed. Also, by using the versatility of numbers, the students have been thinking about various ways to add numbers when carrying (advancing numbers to the next denomination) is involved.

In this lesson, the students will be shown that, in cases where subtraction problems (such as 10 to 19 minus 1 to 9) cannot be solved without borrowing (i.e. by subtracting the number from the number in the ones position). Moreover, they will learn that by using the concepts they have learned in the previous lessons, it is possible to solve these types of problems in the following way: by taking the one from the ten's position to make ten (i.e. borrowing). The students should be aware that once this step is done, they can proceed to solve the problem just like they have learned before. In addition, this lesson hopes to deepen the students' understanding of numbers that are expressed in the positional notation of the decimal system. Furthermore, through this lesson, the students should be able to perform subtraction with borrowing by choosing the most efficient method depending on the values of the numbers.

The students in this class, except student M, were able to understand the concept of subtraction without borrowing as well as the way to use manipulatives to solve this type of subtraction problem. In addition, they succeeded in learning how to come up with the correct answer to such problems. However, the time it takes to solve this type of problem varies greatly among the students, and a great number of students still immediately try to use their fingers rather than using the manipulatives provided such as blocks. Moreover, there are large differences in the students' ability to process the calculations. There are students who can calculate the answers in their heads by using difficult methods such as the following: composition and decomposition of numbers, which is considered the foundation of addition with carrying and subtraction with borrowing; the concept of supplementary numbers of 10 (*ju no hosu*); and the calculation of three (single digit) numbers (*3-kuchi no keisan*). In contrast, there are students who take a long time to obtain the answer even though s/he is using a concrete object. Even under these circumstances, the number of students who answered "I like arithmetic" was comparatively large. The reasons given for these answers were represented in such comments as "It's fun to do activities using manipulatives like blocks and tiles (activities that use manipulatives to facilitate learning (*sosakatsudo*)," or, "It is fun because it is like a quiz game," or, " It is fun because you get to report your answers (in front of the class)."
Thus, regarding the instruction of this lesson, I plan to use problems based on the children's everyday life in order to motivate the children to tackle the subject. Moreover, for activities that use manipulatives to facilitate learning (*sosakatsudo*), I plan to devise instructional materials that will leave a record of the children's thought processes. It is my hope that solving these types of problems (problems based on the children's everyday life) will succeed in achieving the goal of this unit. As for the numbers to use in the

problems for this lesson, I decided on [12 minus 7] because I believe it will elicit many different ideas on ways to solve the problem. It should elicit not only the *subtraction-addition method* (*genkaho*), but also the *subtraction-subtraction method* (*gengenho*), the *counting-subtraction method* (*kazoehiki*), and the *supplement-addition method* (*hokaho*).

Finally, starting with the next lesson, while making the students think about the most efficient calculation method, the students will attempt to master the subtraction-addition method and the subtraction-subtraction method. In order to do this, I will make the students repeatedly practice through such activities as reflexively finding the supplementary numbers of 10 [*ju no hosu*], and decomposing the number that is subtracted in order to match the number in the one's position to the number that is being subtracted from (in subtraction with borrowing).

II. Unit Information

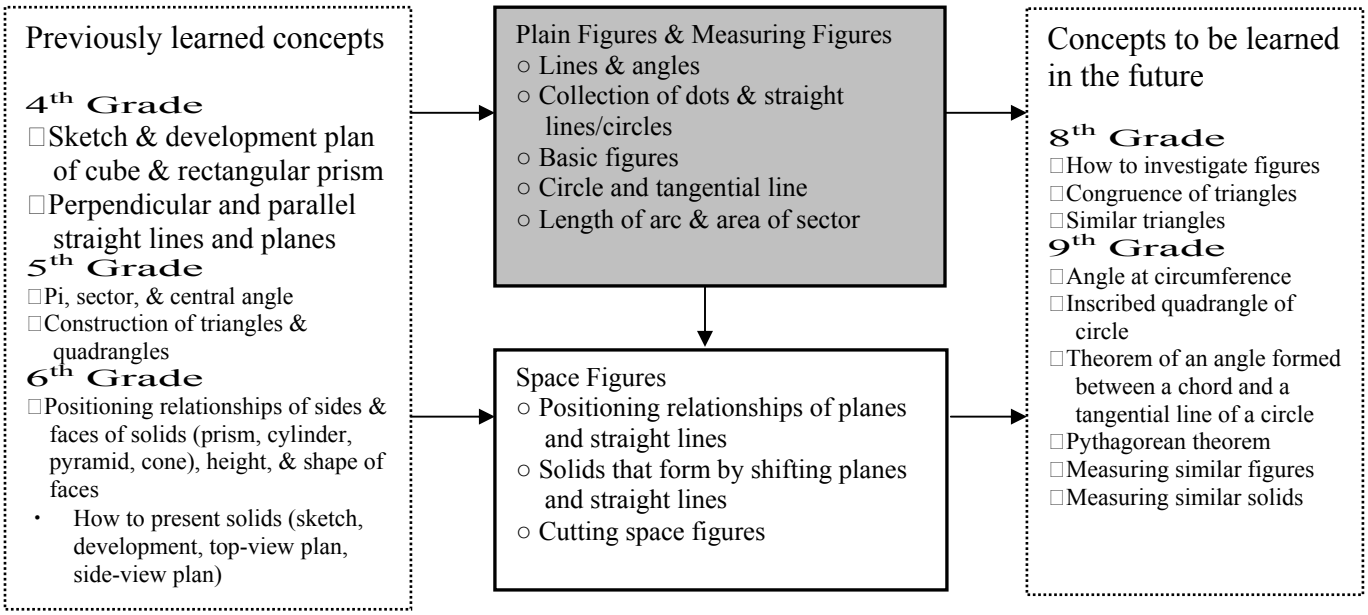
B. Goal(s) of the unit

Example from a first grade subtraction lesson (Tsuta Elementary School, Hiroshima, Japan)

(1) To deepen the students' understanding of the situations where subtraction is used.
(2) To deepen the students' understanding of the writing (formulating) and reading of expressions using symbols and equal signs of subtraction.
(3) To understand the way to calculate subtraction with borrowing by using the opposite concept of addition with carrying of two single digit-numbers. (i.e. 6+7=13 --> 13-7=6)
(4) To confidently and reliably be able to calculate subtraction with borrowing by using the opposite concept as addition with carrying of two single-digit numbers. (i.e. 6+7=13 --> 13-7=6)
(5) To be able to look at a number as a product of many different numbers' differences. (i.e. 5=11-6, 5=12-7, 5=13-8, etc.)

C. How this unit is related to the curriculum

Example from a 7th grade lesson (Greenwich Japanese School, Greenwich, Connecticut)



D. Instructional sequence for the unit:

Example from a first grade subtraction lesson (Tsuta Elementary School, Hiroshima, Japan)

Guidelines for Instruction (12 lessons)

Section 1: To understand how to *formulate an expression* (*risshiki*) for subtraction when borrowing (*kurisagari*) is involved, and how to calculate through concrete manipulative activity.....(4 lessons)

1st lesson: To think about calculation methods for subtraction when borrowing is involved (This period)

2nd lesson: To foster a better understanding of the *subtraction-addition method* (*genkaho*) by calculating 12 minus 9 (12-9).

3rd lesson: To foster a better understanding of the *subtraction-subtraction method* (*gengenho*) by calculating 13 minus 4 (13-4).

4th lesson: To learn how to select the most efficient method of subtraction depending on the given numerical values.

Section 2: To apply subtraction with borrowing to different situations in problems.....(3 lessons)

1st - 3rd lessons: To increase proficiency to solve problems using subtraction with borrowing when you have differences and remainders.

Section 3: To make cards containing subtraction with borrowing problems and practice using the cards when calculating.....(3 lessons)

1st - 3rd lessons: To master the calculation process by enjoying playing games and using the calculation cards.

Section 4: Review.....(2 lessons)

1st - 2nd lessons: To review what the students have learned by doing exercises.

III. Lesson Information

B. Goal(s) of the study lesson

Example from a 2nd grade lesson (Greenwich Japanese School, Greenwich, Connecticut)

1. To solve some new problems, using knowledge acquired in the previous 8 lessons (learning to draw different triangles and quadrilaterals; distinguishing squares, rectangles, right triangles, and other plan figures; and discussing and understanding the definitions and characteristics of these figures).
2. To foster students' individual motivation for learning and to excite their spirit of curiosity by letting them engage in activities that require previously learned knowledge, skills , and approaches.

C. How this study lesson is related to the lesson study goal

Example from a 7th grade lesson (Greenwich Japanese School, Greenwich, Connecticut)

This lesson is a higher potential lesson, which requires using the previously learned concept of measuring a sector and thinking about finding the area of the side of a cone, which has a curved surface. The majority of my students are not good at examining and thinking about solids without having concrete objects. Therefore I planned this lesson to ask the students to actually measure a model of a cone in the classroom to help each individual student to think about the problem more easily. I hope this activity will not be

carried out using student trial and error, but rather will be based on the student's previously learned knowledge. Using this knowledge and having good foresight, thinking out, and coming up with good ideas can help the students discover a higher mathematical solving process. I think this experience can be shared and jointly owned by the students.

D. Process of the study lesson

Example from a first grade subtraction lesson (Tsuta Elementary School, Hiroshima, Japan)

Learning Activities and Questions [*hatsumon*]	Expected Student Reactions	Teacher Response to Student Reactions / Things to Remember	Evaluation*
1. Grasping the Problem Setting "The other day we went leaf collecting, didn't we? What kind of leaves did you get?" "That's right. You collected 12 leaves from the big Ginkgo tree at the Shinto shrine and drew the faces of the people in your family on the leaves. "How many leaves did you use for drawing faces, Student A?" "How many leaves did you use for drawing faces, Student B?" "How many leaves did Ms. Nishi use for drawing faces?" "Ms. Nishi collected 10 leaves and drew 5 faces." "How many leaves are left over?"	• Red and brown leaves • There were miscanthuses and persimmon trees, too. • I collected chestnuts, too. • "The pictures turned out pretty funny." • "I collected so many leaves that I have some left over." A: 4 leaves. Oh, we had a new baby the other day, so 5 leaves. B: Because my family is 4 people, so 4 leaves. Ms. Nishi: 5 leaves. • 5 leaves • Well, (by using fingers) it is 5 leaves.	• Give praise to the students who did great job reporting their answers and raising their hands at various situations during the lesson. • Remind the students that they collected only 12 Ginkgo leaves after they changed the location. • Check out beforehand how many people are in each student's family. • Make sure that all the students know that Ms. Nishi collected only 10 leaves. • Make students understand the problem setting and the teacher is looking for students to answer the questions by using subtraction. • Remind them of the supplementary numbers of 10.	a. Are the students positively trying to recall the event? b. Do the students understand they can solve these problems using subtraction? c. Were the students able to solve the problem 10-5?

"Did everyone have leaves left over?"	• (Yes) there were (leaves) left over. • I had a lot of leaves left over. • I had 8 leaves left over.		
2. <u>Presentation of the Problem Format</u> 1.) presenting the format and using it on previously learned subtraction situations (without regrouping) "Wow, you guys are great! You were studying math even during your Life Studies (a mixture of Social Studies and Science) lesson. What kinds of calculations (of the four: addition, subtraction, multiplication or division) were you doing? "Were the problems you did in your head like this one?"	• It's great, isn't it? • Well, what calculation do I need to use? • Subtraction.	• Point out to the students that they are using arithmetic not only during the arithmetic period, but in a lot of other situations too. • Based on the conversations with the students, present some subtraction problems that they already know how to solve. By reviewing these problems, help students understand the situation of the subtraction problem.	
********** "_____ collected _____ Ginkgo leaves. And then s/he drew _____ pictures of his/her family on the leaves. How many leaves are left over?" ********** "What do you think?" "What should we write in the blanks?"	• I don't know what will be in the blanks. • I don't understand. • It must be the name of the person who collected the leaves. • They are the number of leaves collected and the picture drawn.	• When you present the problem, confirm what the necessary conditions are.	b. Did the students understand what would be in the blanks in order to complete the problem? b. Were the students able to fill in the blanks with appropriate numbers and think about the problem?

"What would you write in the blanks if it is Ms. Nishi's case"	• It is "Ms. Nishi collected 10 Ginkgo leaves. And she drew 5 pictures of her family on the leaves. How many leaves are leftover?"		
"What is the expression (*shiki*) for this problem?" "What is the answer?"	• It is 10-5. • It's 5. • No, it's 5 leaves.		
"Now let's do Ms. Tsukuda's family. Ms. Tsukuda collected 12 leaves just like everybody did. Ms. Tsukuda's family has 2 members so she drew faces on 2 leaves." "Could you make a problem with Ms. Tsukuda's family?"	• It is "Ms. Tsukuda collected 12 Ginkgo leaves. And she drew 2 pictures of her family on the leaves. How many leaves are leftover?"	• Change the numerical values in the problem little by little and confirm that you want them to use subtraction when they have a situation where they have to find the remainder.	b. Were the students able to fill in the blanks with appropriate numbers and think about the problem? c. Were the students able to do the calculation of 12-2?
"Do you understand? What expression did we use to get the answer?" "What is the answer?" "How did we find the answer?"	• It is 12 - 2. • It is 10. • I subtracted 2 from the 2 of 12.	• Remind them of subtraction of two digit numbers without borrowing and confirm that in this case they subtracted the numbers in the ones positions from each other to find the answer.	
2.) Using this format to set up the main problem of the lesosn "Now let's do the Student C's family. How many faces did Student C draw on the leaves?"	• C: I drew 7 faces on the leaves.		

"Let's make this for the problem."	• It is "Student C collected 12 Ginkgo leaves. And then he drew 7 pictures of his family on the leaves. How many leaves are leftover?"		b. Were the students able to fill out the blanks with appropriate numbers and think about the problem?
"O.K. Now, please find out 'what you already know' and 'what the problem is asking'."	• The numbers we know are 12 and 7. • The numbers we know are the number of leaves collected 12 and the number of faces drew on the leaves 7. • What the problem asking is "how many leaves are left over?"		
3. Solving the Main Problem 1.) Thinking about writing an expression (*shiki*). "Think about making an expression from 'what we already know' and 'what the problem in asking'."	• 7-12. • 12-7. • You can't subtract 7 from 2.	• Ask students to write the expression on the handout.	d. Could the students construct the right expression?
2.) Understanding what the problem is asking "That's right. But if you compare 12 and 7, which one is bigger?" "Well, then, it seems like you should be able to subtract it." "Today we're going to think about how to find the answer to 12- 7."	• 12. • It seems hard. • That's easy.	• Make the students notice that you can't subtract using these two one digit numbers (2-7), make them think about how to do this type of calculation.	

3.) Solving the problem individually "Well, we already used the leaves for the drawing, let's think about the problem using these tiles today. We will be telling each other how each of you solved the problem so please write how you did it using words, too."	(a) It looks like I can do the subtraction, but what can I do? (b) Counting-Subtraction Method. • Take them one by one from 12 and find the remainder. • Break up 12 into 10 and 2, take them one by one from 10 and count the remaining numbers. • Since it's 12 minus 7, it's the same until 7, then you count on your fingers 8, 9, 10, 11, and 12. (Supplement-Addition Method) (c) Subtraction-Addition Method • Break 12 up into 10 and 2, then subtract 7 from 10. The answer to that (10 - 7) is 3, then you take the 2 you broke up and add that to get 5. (d) Subtraction-Subtraction Method • Break 7 up into 2 and 5, and subtract 2 from 12. Then you take the answer 10 and subtract 5 from it to get the answer, 5.	• Give a tile representing the number 10 (long tile) and two individual tiles and let them cut the 10-tile freely in order to subtract 7. • Ask students to turn the tiles over and leave them on the drawing paper instead of taking them away when they subtract in order to understand where the numbers were subtracted. • Ask the students to write down their own solution using words on the handout. • Find out which students are the following 3 types when it comes to addition with carrying: Type A: Composition and decomposition (breaking down) of numbers is simple for this type of student. Able to calculate it in his/her head. Type B: Can find the answer by manipulating some sort of half concrete object. Type C: Finds it difficult to calculate unless he/she uses some sort of concrete object or his/her fingers. Give extra individual help especially to type C students when the teacher walks around and observe the students. Provide Ginkgo leaves if the type C students need them to think the problem.	a. Are the students positively trying to do the subtraction calculation using concrete objects? c. Could the students understand the meaning and the method when calculating 12-7 c. Could the students do the calculation 12-7?

4. <u>Polishing (*Neriage*) and Presenting Individual Solution Methods</u> "Please teach how you came up with the answer clearly to the other students in the classroom."		• During the time the teacher walks around the classroom to see how the students are doing (*kikanjunshi*) I will take some notes on how the students are thinking. And I would like to ask the students to present in the order of (b), (c), (d). (refer to the student's expected solution methods above in the column "Expected Student Reactions")	a. Could the students present their own ideas in a loud voice? a. Could the students listen to their friends' presentations carefully?
"Are there any other ways to find the answer?" ("Why did you break 12 up into 10 and 2?") ("Why did you break 7 up into 2 and 5?")	• Yes, yes, there are. • Why did you break 12 up into 10 and 2? • Why did you break 7 up into 2 and 5?	• Ask the students to ask questions when they don't understand what other students presented because of lack of explanation. If the students do not ask any questions, the teacher will ask questions (so the explanation will be clear).	b. Did the students understand there are many ways to solve subtraction problems that involve borrowing?
<u>5. Summary and Announcement for the Next Lesson</u> "Let's try to solve 12-5 using whatever method you like." "What do you think the best way is to solve 12-9?" "Let's try to find out what method is the best in the next lesson."	• I will do it the same way I did it before. • I wonder if the solution that K used is more convenient?" • I will try to do it the way that N did. • I won't know until I do it. • Well, I think method (b) is the best. • I think method (c) is faster. •I want to try to solve it.	• When the problem is posed, the teacher tells the students whose case they are dealing with (to be consistent with the other problems). • Take notes on the students who are listening to their friends' presentations and trying to solve the problem in a different way than they did before. Try to incorporate these observations into the next lesson. (Ask the students	c. Could the students solve the problem using the method that they understood and agree with each other?

		to write the student's name who's solution method they liked, in order to solve the practice problem in the handout) • Try to help and lead the students who are still using the method of subtracting numbers one by one from 12 to the method of breaking up 12 into 10 and 2 and subtracting the numbers one by one from 10 and counting the remaining numbers (because this method will lead to the way of thinking on "Subtraction-Addition" method).	a. Will the students be motivated to learn the following lesson?

* Each heading alphabet (a, b, c, and d) in the column "Evaluation" corresponds to the four categories of goals for this lesson.

E. Evaluation

Example from a 5th grade lesson (Greenwich Japanese School, Greenwich, Connecticut)

- Were the students able to find many kinds of per unit quantities by using the data given to them (area of land, area of forestry, and population)
- Were the students able to compare, think out, and investigate the situation in Japan and the U.S, using calculated numbers?